The Integration of the German Medical Service into the Principle of Network Enabled Operations (NEO)

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1.0 INTRODUCTION

In his days, the much-quoted and widely renowned General Clausewitz demanded that any decision should be based on comprehensive information. He observed that a 'great part of the information obtained in war is contradictory, a still greater part is false, and by far the greatest part is of a doubtful character'.

In network-based operations control, information becomes the primary factor, taking precedence over the other factors, that is, forces, space and time. Revolutionary technological advancements allow for large quantities of information to be securely collected, processed and transmitted in a fast and structured way. We need to dominate the information space.

2.0 DEFINITION OF NETWORK-ENABLED OPERATIONS

To allow for this factor, the overarching principle of network-enabled operations (NEO) is applied.

NEO means the networking of:

- All relevant entities
- Sensors, effectors
- Command-and-control systems
- Soldiers on the battlefield
- Command facilities in the country of deployment and at the operational base in Germany.

NEO are designed to improve the command, control and decision-making process of the armed forces. Especially, they are intended to:

- Establish a current and comprehensive joint situation picture and create joint situation awareness and situational understanding;
- Maintain a knowledge of all relevant factors of influence;
- Make a situation assessment to develop soundly reviewed fast-response options;
- Accelerate the processes of command-and-control.

In accordance with the triad of 'information superiority – command superiority – effects superiority', operations are to be conducted swiftly, flexibly and with precision while keeping the personnel effort as low as possible.

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2.1 NEO – Capabilities of the Bundeswehr Medical Service

With respect to the Bundeswehr Medical Service, NEO comprises the following capabilities so as to achieve a higher degree of effects superiority:

- A comprehensive joint situation picture (Medical Common Operational Picture) which is based on up-to-date, correct and non-contradictory data, and which keeps data available for the appropriate decision-makers;
- Decision-making based on action options;
- Command superiority because of accelerated command-and-control processes.

As for the Bundeswehr Medical Service, effects superiority means that efficient and high-quality medical support is provided by synchronising the employment of medical assets faster and with greater precision in terms of space and time, both in the area of operations and at the medical home base (reachback).

2.2 Medical Service Information Space

Within the so-called Medical Service Information Space, information from all levels of command, medical facilities, and medical units is generated, processed, assessed and disseminated. This means that, if possible, each report and each item of information will be fed into the Medical Service Information Space only once. Users may retrieve information from the Medical Service Information Space at any time and at any location, depending on their roles and tasks within the overall system of the Medical Service.

All the information required for accomplishing the mission are made available in an adequately complete fashion and in every kind of tactical situation, that is, using both the ‘push principle’ and the ‘pull principle’, while allowing for the constraints imposed by data protection regulations, the doctor-patient privilege, and IT security rules.

Unrestricted technical ability for NEO exists if communication within an optimally structured IT-supported information space is possible largely without media discontinuities. This means that technical information systems and the command-and-control information systems of the armed forces and the individual armed services will be networked through technical systems.

3.0 COMMAND SUPPORT REQUIREMENTS OF THE GERMAN MEDICAL SERVICE

Command support comprises the functional tasks of information management, information supply, and IT security. Information supply includes the sub-areas of information transmission and information processing. The Bundeswehr Medical Service must have modern equipment and command support assets of adequate efficiency in order to provide medical care.

In this respect, the non-linearity of the modern battlefield shows certain parallels to the German concept of deployed medical service assets: Medical care is not limited to the areas of responsibility of components, armed services or combat sectors.

Modern-day requirements of quality casualty care are ensured by the network-type structure of the overall system of the Deployed Medical Service and by the consistent application of the joint / combined principle in the assignment of medical assets. For this purpose, the Bundeswehr Medical Service needs an efficient command support structure across all organisational areas and components, with modern information and communication systems.

All mobile units – ranging from a field hospital to a medical team – of the Bundeswehr Joint Medical Service require digital information transmission and digital information processing capabilities – data / language transmission – to maintain the flow of information. Fast evacuation and optimal casualty care can be ensured only by continuing near-real-time communication / data transmission.

The task spectrum of the Bundeswehr Medical Service, too, requires a near-real-time, interruption-free and secure exchange of information between all echelons of military command, the deployed medical units, and all supporting components, including multinational partners. Military leaders of the Medical Service and their staffs need to be enabled to discharge their command duties in any type of situation, making use of the available personnel, material and organisational conditions.

At present, the armed forces – and this includes the Medical Service, too – are far from having achieved this. But what we need to do now is to establish the prerequisites for this process by means of continuing development.

The Bundeswehr Joint Medical Service still relies almost exclusively on out-of-date analog technology. The same applies to information processing, which is sometimes still done using overlays, paper and 'non-networked hardware'.

Expedient solutions have been procured for our ongoing missions, where experience is now being gained for a more comprehensive approach at establishing modern-type command support structures within the Bundeswehr Medical Service. We have a lot of catching-up to do in this field because in the three armed services of the Bundeswehr, modern command-and-control equipment was not really in ample supply for the medical troops back in those years when the Medical Service had yet to become an organisational area in its own right.

3.1 Joint Command Information System (CIS)

To establish network-enabled operations capabilities, the armed forces need a Joint Command Information System (CIS). The Armed Forces CIS supports military command-and-control at the various command echelons. Currently, a system-of-systems approach is being established as the primary means to ensure the information flow within the armed forces, which includes the Armed Forces CIS and the CCI systems of the individual armed services.

As a first step, a core system is established in the form of an Armed Forces CIS for military commands and headquarters at the operational and strategic levels which have multi-service command-and-control responsibilities. Step by step, we intend to enhance those functions of the Armed Forces CIS that have been defined as core capabilities, and then, possibly, to integrate the CIS of the armed services into a Joint CIS. However, we are going to retain the armed services' individual CIS, which will not be 'given up' until it is convincingly proven that the Armed Forces CIS is equally serviceable.

4.0 MODIFIED ARMY'S CIS FOR THE GERMAN MEDICAL SERVICE

Therefore, the Bundeswehr Joint Medical Service decided that a slightly modified version of the German Army's CIS should be used for Joint Medical Service command-and-control purposes until the Armed Forces CIS is finally and fully established. Also, the Army CIS is going to be used at ISAF starting next year.

The Army CIS provides technical support of national and multinational command-and-control processes at all tactical command levels, as well as for all basic functional areas and special staff sections. CIS equipment will be installed in ground vehicles, command posts, medical facilities, aircraft and ships.

The Army CIS comprises three components, the first one being the software with its graphic user interface. The software has a module-type structure. The individual tools, such as maps and situation summaries, standard reports, staff functions and GPS vehicle tracking, have access to a database (Oracle).

The hardware is the second component. It consists of a set of computer workstations interlinked with vehicles, medical facilities and command posts at different tactical command echelons.

Information transfer is the third component. For this purpose, all medical vehicles and command posts are planned to be integrated into a long-distance, wideband (64 kbit/s or more) command-and-control component. As for distances of up to 20 kilometres, data transmission can often be effected with radio equipment (VHF, SEM 80/90). Distances of more than 20 kilometres, however, will definitively require long-distance, wideband equipment, such as SATCOM or HF systems.

As for information transmission, a key factor will be to provide demand-oriented transmission capacity and to establish an end-to-end link of information and communication systems using suitable communication networks, while taking into consideration the particularities of transmission devices, such as their capacities and performance data. While it is indeed justified to call for end-to-end, near-real-time communication and data transmission to provide fast rescue services and optimal medical care to casualties in the field, it is a given fact that even the Medical Service will not be able to overcome the laws of physics.

Supporting the casualty control effort at the various levels will require different types of hardware components. For example, a PECC will have control station equipment, including several monitors and a large situation map placed side by side. There will be two versions for ground-based rescue assets:

- Large rescue assets (such as the Yak) will have 2 portable laptops, one for the driver's cabin and one for the casualty treatment cabin;
- Small rescue assets (such as the EAGLE) will have only 1 laptop.

The Bundeswehr communication server is the central and universal component in the use of various types of radio sets for transmitting information. By introducing the Bundeswehr communication server, the SATCOM / HF / VHF systems used by mobile emergency physician teams, medical teams, and mobile medical facilities will have radio data transmission capability. The communication server establishes data links automatically or according to the user's configuration. It works similar to a mail server. The communication server has a bi-directional address learning function.

Examples for some functions:

- Map-situation application, which contains important tactical information for the user, like the location of medical treatment facilities and geo-references provided by GPS sensors attached to vehicles.
- Command processing tool with the required formats.
- Staff functions to generate overviews for the basic functional areas, such as for personnel or materiel; for example, Basic Functional Area 3 staff may use it for computing road marches.
- Reporting function, which permits the use of standard formats. The reports are linked to a sign or tactical symbol, which is then automatically transferred to the map. The accident or incident is then displayed to every recipient of the message, showing a terrain reference on his map.
- Mail function plus receipt function to show that the mail has reached the addressee.

5.0 PATIENT TRACKING AND REGULATING

'Blood is the price of victory', as Clausewitz once observed. Even in our times, current statistics say that eighty percent of death casualties in military conflicts die as a result of blood loss. The mainstays of all our activities are self-aid and buddy aid as well as the integrated system of qualified casualty transportation and swift access to medical treatment. Evaluations of national and international lessons learned have shown that a casualty's chances of survival are enhanced if medical personnel take positive action at an early stage, which also is conducive to the casualty's swift and, possibly, full recovery. For this we require a system for Patient Tracking and Patient Regulating.

Patient Tracking is the precise and continuous monitoring of the location and the intended destination of the casualty / patient in the medical treatment and evacuation chain. In short: Who is When and Where, and what is his Destination. This does not include the status of the patient, needed treatment or available medical facilities.

Patient Regulating is a process of control and co-ordination to ensure casualties / patients are evacuated to medical treatment facilities which are best capable of providing the required treatment, and which have the required treatment capabilities available.

5.1 PECC

Central controlling, co-ordination and monitoring of casualty evacuation enables us to use available medical facilities and means of evacuation as effectively and efficiently as possible. Especially, this is true for Rotary-Wing Medical Evacuation = RW MEDEVAC, which is a scarce resource. In certain situations, RW MEDEVAC is the only means available to ensure that the treatment of soldiers who have sustained life-threatening injuries may be administered in time by qualified and specialised physicians.

The PECC at the major unit level is collocated with the Operations Centre (OC), the Tactical Operations Centre (TOC), and the Joint Operations Centre (JOC). This collocation is required for a direct exchange of information between the PECC and the tactical / operational command level so as to allow for both medical aspects and tactical / operational aspects. The effectiveness of casualty evacuation control will especially depend on the availability of up-to-date information as to the casualty's condition and, in particular, the availability of an updated picture of the medical as well as tactical / operational situation.

6.0 MEDICAL COMMAND-AND-CONTROL EMPLOYMENT SYSTEM

To be able to meet the described requirements, the Bundeswehr Joint Medical Service will introduce the SAFES software together with the Army CIS. SAFES is short for 'Sanitätsdienstliches Führungseinsatzsystem', which translates as 'Medical Command-and-Control Employment System'.

Essentially, SAFES is intended to increase the chances of survival and recovery of injured soldiers across all echelons of command, even in a mass casualty situation (such as terrorist attacks, massive use of weaponry, or landmine incidents), by means of an IT-supported control system.

This is done by:

- Optimising casualty evacuation management through improved situation assessment and process optimisation; command-and-control processes will be accelerated and facilitated through automation;
- Improved information management by providing precise medical information at an earlier stage;
- Casualty documentation

- Casualty tracking.

All facilities, components and assets involved in casualty care, control and evacuation are going to have the same, joint type of IT equipment and software.

These data serve to improve casualty management planning. Depending on the type and scene of the incident, the system allows us to select the nearest available means of evacuation and the facility which can admit the casualty and is best suited for providing the required treatment. The programme is designed to suggest options for further action. Also, treatment facilities may be informed early on as to the expected time of arrival and the condition of the casualty. The system's patient tracking function will automatically record and trace the routing of the casualty.

SAFES automatically delivers information on the medical situation, such as the current workload of medical facilities and the availability status of evacuation assets. As an extra service to the user, the system will also list the performance capacities of medical facilities and casualty evacuation assets.

By linking the SAFES software to the Army CIS software, the Medical Service has unlimited access to the respective tactical data. Emergency messages posted by tactical units will automatically be routed through the SAFES system.

As a follow-on measure, and in a joint approach, SAFES is currently being integrated into the Armed Forces CIS, Air Force CIS and Navy CIS by adapting the software. Already at this stage, messages from the German civilian system or the systems of international partners may be fed into the SAFES system.

6.1 Medical Documentation

To provide for swift and simple transmission and handling of information, the Patient Tracking system separates a patient's personal data from the medical data; this is done by anonymising both sets of information. Because of the strict separation, it becomes possible to transmit and store non-encrypted clinical data in keeping with data protection regulations and the doctor-patient privilege. For this purpose, each casualty will be assigned a unique pseudonymised identification number (PID), which prevents a casualty's identity from being traced, helps to avoid mixups, and allows only authorised staff to clearly identify a patient.

As laid down in the STANAG, the DIVI protocol or the field medical card will be used as a documentation mask in the SAFES System.

Paper-based digital documentation is being tested during our ongoing operations and through emergency physician services at the Ulm Bundeswehr Hospital. This documentation technology has three components: digital paper, a digital pen, and application software which reads and correlates data and transfers it to the system. This technology has proven its documentation quality and sustainability. Therefore it could be an excellent supplement for the SAFES-based pre-clinical treatment documentation to allow clinical governance and to support a trauma registry.

6.2 External Data Medium

The entire medical documentation is stored on an external data medium which every soldier carries on his person. The external data medium is a hardened electronic storage module carried on the soldier's person, much like the identification tag. The module contains a basic set of medical emergency data, with further data to be added as required for documentation purposes.

The basic set of data includes the following:

- Organisational data:
  - Personal ID
  - Military unit
- Medical emergency data
  - Blood group (AB0 system with rhesus factor)
  - Allergies
  - Long-term diagnoses
  - Long-term medication

We seek to use a contactless link to the respective SAFES computer. Its technical characteristics include:

- Flash memory
- Dimensions: approx. 25 by 60 by 10mm
- Universal physical interface (USB) as second data interface, and loading stick
- Interoperable with COTS hardware under (Windows XP / VISTA / Windows 7)
- No proprietary interface
- Contactless read / write access within a 2 to 10-metre diameter from the patient
- Rapid data transmission and retrieval
- On / off mode for data encryption
- Storage capacity: up to 2-?GB
- Storage battery lasts 6 to 9 months per charge
- Hardened
- Decontaminable
- Large bandwidth and a very large data throughput rate (>100Mbps) at short distances (~10m)
- Hard to detect.

7.0 SUMMARY

The SAFES project in combination with the Army CIS is a complex procurement project consisting of the following components: Means of communication, software and IT hardware, vehicles, and technical equipment. Other factors to be considered include personnel, training, organisation, employment, and command doctrine. Procurement is scheduled to start next year, depending on the budgetary situation.

SAFES will enhance the medical care and future command-and-control capability of the Bundeswehr Medical Service and establish an initial NEO capability.

We have taken the initial steps and measures towards establishing NEO capabilities in the Bundeswehr Medical Service. Now, we have to start working on the important follow-on tasks. The Joint Medical Service of the Bundeswehr is going to take an active role in the overall effort to further improve the Medical Service's NEO integration and to engage in its purposeful development for the benefit of the ill, injured and wounded people entrusted to its care.

NEO in the Medical Service also includes quality management in the sense of "Clinical Governance" (continual improvement of medical support in the area of operation) and "Evidence Based Medicine". A

cornerstone of this is the "caseload / trauma" register. The registered data may be used to analyse and assess therapy schemes and treatment results and may also, in part, be compared with civilian data. These results will then have an influence on treatment algorithms, medical employment concepts, and the procurement of pharmaceuticals and medical equipment.

All our efforts are geared towards establishing an Integrated Medical Information and Communication System that provides interfaces with NATO as well. Much like the planned NATO system MEDICS, this will include diverse functionalities such as the use of tools, which include, for example, Operations Research (OR), modelling and simulation (M&S), disease surveillance, and e-health.

Regrettably, though, we will not be able to fully adhere to the age-old management adage of 'more pepper, less paper', because when it comes to the issue of money in the military sphere, all requests need to be submitted with a full and comprehensive set of supporting documentation.